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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|-------------|----------------------|---------------------|------------------|
| 10/701,499 | 11/06/2003 | Takeshi Tachibana | KOBE.0057 | 7640 |
| 7590 | 12/15/2004 | | EXAMINER | |
| Reed Smith, LLP Suite 1400 3110 Fairview Park Drive Falls Church, VA 20042 | | | RAO, SHRINIVAS H | |
| | | | ART UNIT | PAPER NUMBER |
| | | | 2814 | |

DATE MAILED: 12/15/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/701,499

Applicant(s)

TACHIBANA ET AL.

Examiner

Steven H. Rao

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 06 November 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☐ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 06 November 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date <u>11/06/2003</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Priority

Receipt is acknowledged of paper submitted under 35 U.S.C. 119(a)-(d), claiming priority from Japanese Patent Application Nos. 2002-32453 and 2002-324473 both filed on November 07, 2002 which papers have been placed of record in the file.

Election/Restrictions

Restriction to one of the following inventions is required under 35 U.S.C. 121:

- I. Claims 1-4 are drawn to a semiconductor device, classified in class 257, subclass 276 +.
- II. Claims 7-20 are, drawn to a semiconductor package, classified in class 257, subclass 678+

Inventions Gr. I and II are related as combination and subcombination.

Inventions in this relationship are distinct if it can be shown that (1) the combination as claimed does not require the particulars of the subcombination as claimed for patentability, and (2) that the subcombination has utility by itself or in other combinations (MPEP § 806.05(c)).

In the instant case, the combination (semiconductor device having heat spreader) as claimed does not require the particulars of the subcombination (heat spreader) as claimed because the semiconductor device need not have the diamond layer having a fiber structure (cl . 7) across the thickness or microcrystalline structure (cl. 14) .

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Because these inventions are distinct for the reasons given above and the search required for Group I is not required for Group II, restriction for examination purposes as indicated is proper.

During a telephone conversation with Juan Carlos Marquez (34,072) on December 06, 2004 a provisional election was made without traverse to prosecute the invention of Gr. I , claims 1-6.

Affirmation of this election must be made by applicant in replying to this Office action.

Claims 7-20 withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Information Disclosure Statement

Acknowledgment is made of receipt of Applicant's Information Disclosure Statement (PTO-1449) filled November 06, 2003.

The references on PTO 1499 submitted on 11/06/2003 are acknowledged. All the cited references have been considered. However the foreign patents and documents

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cited by applicant are considered to the extent that could be understood from the abstract and drawings.

Preliminary Amendment Status

Acknowledgment is made of entry of preliminary amendment filed 11/06 / 2003. Therefore claims 5,13 and 20 as amended by the preliminary amendment and claims 1-4,6-12 and 14-19 as previously recited and reproduced in the preliminary amendment are currently pending in the Application.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1 to 5 are rejected under 35 U.S.C. 102 as being anticipated by over Clevenger et al. (U.S. Patent No. 6,337,513, herein after Clevenger) .

With respect to claim 1 Clevenger describes a semiconductor device having a heat spreader comprising diamond or a diamond-containing material (Clevenger fig.1

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#14, col. 3 lines 65-67) having a thermal conductivity of . of 350 W/(m K) or more is an inherent property of diamond , which has a thermal conductivity about 110-150 (1000 for diamond , eg. see Clevenger table 1,) The heat spreader being directly disposed entirely or partially on the reverse surface of the semiconductor device. (Clevenger fig.1 #14 on reverse surface of 10, and same as specification figure 1A, spec. page 9 last six lines also figures 6 E-F, col. 6 lines 15-25).

With respect to claim 2 Clevenger describes the semiconductor device according to Claim 1, wherein the diamond-containing material is a composite of a diamond layer and a ceramic layer or a mixture of diamond particles and ceramic particles, the ceramic layer or the ceramic particles (Clevenger col. 3 line 19) comprising at least one of silicon carbide and aluminum nitride. (Clevenger col. 3 lines 18-25, silicon carbide) .

With respect to claim 3 Clevenger describes the semiconductor device according to Claim 1, wherein the heat spreader is directly disposed on a substrate for the semiconductor device. (Clevenger fig. 1, col. 4 lines 1-5)

With respect to claim 4 Clevenger describes the semiconductor device according to Claim 1, wherein the heat spreader has an irregular surface facing away from the semiconductor device. (Clevenger figures 6c-d # 62)

With respect to claim 5 Clevenger describes a semiconductor package accommodating the semiconductor device 1 having a heat spreader comprising diamond or a diamond-containing material having a thermal conductivity of 350 W/(mK) or more. (Clevenger fig.1 #14, col. 3 lines 65-67).

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The heat spreader being directly disposed entirely or partially on the reverse surface of the semiconductor device, (Clevenger fig.1 #14 on reverse surface of 10) wherein a metal heat sink or a metal radiating fin is bonded on a surface of the heat spreader facing away from the semiconductor device. (Clevenger figure 4 # 44).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Clevenger (U.S Patent No. 6,337,513, herein after Clevenger) as applied to claims 1-5 above and further in view of Anschel (U.S. Patent No. 4,914,551, herein after Anschel).

With respect to claim 6, Clevenger describes the semiconductor package according to Claim 5,.

Clevenger does not specifically describe a polymer adhesive layer is used to bond the metal heat sink or the metal radiating fin on the surface of the heat spreader.

However , Anschel a patent from the same filed of endeavor describes in col. 4 lines 45-55 a polymer adhesive layer is used to bond the metal heat sink or the metal radiating fin on the surface of the heat spreader to provide an electrically insulative and highly thermally conductive adhesive.

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Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to include Anschel's polymer adhesive layer is used to bond the metal heat sink or the metal radiating fin on the surface of the heat spreader in Clevenger's device using an unspecified adhesive to provide an electrically insulative and highly thermally conductive adhesive. (Anschel col. 4 lines 20-25).

The remaining limitations of claim 6 are :

and cilia are formed on the surface of the heat spreader so that the polymer adhesive layer spreads over part of the cilia.(Anschel figure 1, cilia -33 , adhesive 51 spreading over bottom part of 33).

Any inquiry concerning this communication or earlier communication from the examiner should be directed to Steven H. Rao whose telephone number is (571) 272-1718. The examiner can normally be reached on Monday- Friday from approximately 7:00 a.m. to 5:30 p.m.

Any inquiry of a general nature or relating to the status of this application should be directed to the Group receptionist whose telephone number is (703) 308-0956. The Group facsimile number is (703) 308-7724.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should

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you have questions on access to the Private PAIR system, contact the Electronic
Business Center (EBC) at 866-217-9197 (toll-free).

A handwritten signature in black ink, appearing to read 'SH Rao', written over the printed name.

Steven H .Rao

Patent Examiner

December 10, 2004